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Ecological Observations on Siberian (Lemmus sibiricus) and Collared (Dicrostonyx torquatus) Lemmings on Wrangel Island

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Lemmus sibiricus, on Wrangel Island, inhabits plains regions of tundra, and Dicrostonyx torquatus mainly dry subble slopes. The density of burrows of L. sibiricus on typical habitats in 1964 amounted to 8-11 per hectare, and that of D. torquatus to 3-6 per hectare. The principal summer foods of the sibirian lemmings are various grasses. In the case of the collared lemming the composition of the food is more diverse, including leaves and flowers of motley grass. In the main part of the populations of both species there were no observations of subnivean reproduction in 1964, which caused a general slump in numbers in 1965.

Specific data on the ecology of palearctic siberian lemmings (Lemmus sibiricus Kerr.) and collared lemmings (Dicrostonyx torquatus Pall.) are available from only three regions - Yamal (Dunaeva and Kucheruk, 1941; Korzinkina, 1946; Dunaeva, 1948; Kopein, 1958), Central Taimyr (Sdobnikov, 1955, 1957) and the tundra of the lower Kola Peninsula (Sokolov et al., 1958). In the present report the results of observations made in 1964 at Wrangel Island are presented.

Distribution

The greater part of Wrangel Island is mountainous - three

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parallel ridges, up to approximately 1000 m. in height, stretch from west to east, coming to an abrupt end in rocky cliffs at the sea. The lemmings penetrate this area only along the river valleys. They more uniformly penetrate the plains regions of the tundra, bordering the island on the north and south. The predominant types of vegetation on the island are arctic tundras; arctic deserts (in the understanding of B.N. Gorodkov, 1958) occupy only the upper parts of the rising mountain chains. The distribution of lemmings according to habitats was studied in detail on the upper reaches of the Tundrova River, where the base camp of the expedition was located. Colonies of siberian lemmings in this region were limited exclusively to the river valleys and brooks or streams with motley grass-dryad and dryad-willow shrub tundra of medium moisture. There, a noticeable mosaic is observed in the distribution of their burrows; usually they were dug in elevated parts of troughs and polygons, small ridges, hills and other rises of microrelief on which willow (Salix glauca and S. lanata), spotted dryad (Dryas punctata) and motley grass are abundant. In analagous areas on dry hills, occasionally one can also encounter the burrows of the collared lemming, but the abundance of this species here, in the extreme case, is 4 times inferior to that of the siberian lemming (see below).

Collared lemmings in the mentioned region occupy the lower and middle parts of rubble slopes of the Tundrova Mountain covered by motley grass associations. In suitable conditions collared lemming burrows are found among sparse willow shrub-dryad groupings with grey willow (S. glauca) and eight-petaled dryad (D. octopetala).

In the vicinity of the middle course of the Mamontova River valley, nearly in the center of the island, siberian lemming colonies were usually in the wide river floodplain

and on low terraces. Vegetation cover here is made up principally of motley grass-dryad tundra, with entire-leaved dryad (D. integrifolia). In the valley of the Mamontova River, the burrows of D. Torquatus are found on the slopes of the valley and on the flat tops of the low rises amidst motley grass-lichen and motley grass-dryad tundras.

In this manner, the siberian lemmings on Wrangel Island populate mainly the plains regions of tundras of various degrees of moisture and greatly diverse vegetational composition; whereas collared lemmings definitely are strongly attracted to dry rubble slopes with just as diverse, though also less closed, vegetational cover.

Numbers

Analysis of 116 snowy owl pellets, collected in October, permitted us to obtain figures characterizing the quantitative relationship between the populations of the two species of lemmings. It was found that the exact number of definite remains of siberian lemmings 4 times exceeded the number of bone fragments of the collared lemming. Similar results of analyses of owl pellets were obtained by V.M. Sdobnikov (1955) in central Taimyr; there the relationship between populations of siberian and collared lemmings was 6:1. Watson (A. Watson, 1956), on the basis of his own observations on Baffin Island and the analysis of much literary data, also came to the conclusion that, in the majority of the tundra regions of North America, brown lemmings considerably exceed the number of collared lemmings.[1] Analysis of the causes of the usual predominance of the siberian lemming compared to the collared

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1 It is understood that we speak about those cases when the "cycles" of the mentioned species fall together.

lemming, apart from more perfect thermoregulation (Tyulin, 1940; Schwartz, 1963), a greater degree of eurtopicity and increased fecundity of the former species, next indicates as well the possibility of competitive interaction between them.

In the beginning of the summer, after the lemmings were settled in burrows, at the time of the general mean of their numbers (as it occurred, specifically in the year of our observations) and, consequently the lack of continuous settlement, the calculation of inhabited burrows on trial grounds was made possible. The inhabited burrows are easily indenfified by the fresh droppings near the entrance hole. In the valley of one of the tributaries of the Tundrova River, in dryad-willow shrub tundra, the density of inhabited siberian lemming burrows was, according to our calculations, 8 per hectare. The density of collared lemming burrows in this same area was, in all, only 2 per hectare. Collared lemmings populated rubbly motley grass tundra along the adjoining elevated slopes in somewhat greater density - 3 to 4 burrows per hectare. In the wide floodplain of the Mamontova River, in areas of motley grass-lichen tundra, 11 siberian lemming burrows per hectare were counted. In the same place, on slopes and low terraces with Oxytropis-dryad and motley grass-lichen associations, there were from 5 to 6 collared lemming burrows per hectare. A count of siberian lemming winter nests in the plains moss-motley grass tundra between the Tundrova and Medvezh'eii Rivers has shown that the area was settled with up to 30 nests per hectare in the winter of 1963-1964. The snow cover in this area, judged by observations in April, was fairly evenly distributed and the depth was 0.4 to 0.5 m.

Refuges

The summer siberian lemming burrows on the island, judged

according to our excavations were, on the whole, uniformly arranged andnnot basically different from refuges of this type in other nearby areas (Dunaeva, 1948; Sdobnikov, 1957). The nesting chamber, usually situated at a depth of 10-30 cm., is connected to the surface by a few (usually not more than 3 to 5) short branch tunnels. Siberian lemmings inhabiting colonies of snow geese establish their burrows on the same hummocks or mounds on top of which are found goose nests. Incubating snow goose females usually do not notice the animals feeding nearby; whereas the males do not miss the opportunity tosstrike with their bills at lemmings running by. Collared lemming burrows are frequently confined to the slopes of mountain chains and along the borders of terraces. By no means are they inferior to the complexity of siberian lemming refuges; V.M. Sdobnikov (1957) also notes this for Northern Taimyr. Usually they have several branch tunnels, sometimes arranged in two tiers with up to 6 to 8 entry holes and one nesting chamber. Often one can encounter a branch tunnel coming to an end in a blind alley, which serves as a lavatory (see figure). Judged by theyresults of the catch at the burrows of both species of lemmings, each pair of adults occupies separate burrows at the beginning of the summer.

Food Habits

Besides the analysis of 65 stomachs and visual observations on feeding individuals, collections of little pieces obtained from the mouth cavities of the animals and from their burrows served as the sources of data on the food habits of lemmings from Wrangel in the snowless period. We note, first of all, the difference in feeding behaviour between siberian and collared lemmings. Members of the first species, as a rule, feed on

the surface, gnawing around the green parts of plants along the edges of its surface runway. Sometimes they stand up on their rear paws, while the forepaws rest on the edge of the runway. Collared lemmings seldom eat forage on the ground surface; usually they carry the gnawed down part of plants into the burrow. Invisibility is connected with considerably less defence of their site. Even the difference in composition of foods between the two studied species is sufficiently noticeable. Our material, in general, confirms the conclusion of T.N. Dunaeva (1948) concerning more narrow forage specialization of the siberian lemming. However in the specific conditions of Wrangel, due to its exceptionally rich flora (over 200 species of flowering plants) and diverse vegetational groups, the base of the summer ration of the siberian lemming is not made up of cotton grasses and sedges, as it is noted for in the majority of the Eurasian regions (Dunaeva, 1948; Tikhomirov, 1955; Sdobnikov, 1957; Kopein, 1958), but according to the preference for difference grasses with an insignificant admixture of motley grass[2]. Of the separate species of grasses, it was noted that the young sprouts of bluegrasses - arctic (Poa arctica), dove-colour (P. abbreviata), and anadyr (P. anadyrica), altai fescue (Festuca altaica), arctic hairgrass (Deschampsia brevifolia), Fisher's dupontia (Dupontia Fisherii), and broadleaved arctagrostia (Arctagrostis arundinaces) were eaten. In addition, in the composition of summer forage enter two species of sedge - rock and brilliant (Carex repestris, C. lugens) and two species of woodrush - confusing and snow (Luzula confusa, L. nivalis). Of the motley grasses, the siberian lemming consumes the leaves of northern Jacob's ladder (Polemonium boreale), mountain sorrel (Oxyria digina) and

2 Deep gratitude to V.V. Petrovskomu for the determination of plants.

spotted dryad (Dryas punctata). They also eat the leaves of willows (Salix glauca, S. lanata). Cottongrass is absent in the composition of the majority of the associations on the island. The composition of food plants of the collared lemming is more diverse, basically in leaves and flowering plants, and, specifically, headed valerian (Valeriana capitata), northern rhodiola (Rhodiola borealis), whorled lousewort (Pedicularis verticillata), northern Jacob's ladder (Polemonium boreale), headed leek (Allium schoenoprasum), and tufted saxifrage (Saxifraga caespitosa). Willows are used more intensively. In return, grasses act a minor role in the ration of the collared lemming.

Reproduction

The departure of lemmings from subnivean tunnels onto the surface and their tracks between them were noted for the first time in the beginning of the third dekada of March. On 24 March an adult female collared lemming was caught, weight 132.2 g., with four well-formed embryos, weight up to 2.5 g. each. Three males, obtained at the same time, had testes with an average size of 5.2 to 7.6 mm and appendage length of 11.5 mm. Entrances in the snow were encountered until the end of March, while afterwards they collapsed with snow and were not re-established. The impression was gained that a momentary outbreak of activity of animals occurred, possibly combined with subnivean reproduction. However, the age structure of siberian and collared lemmings in June, after snow melt, clearly indicated that the greater part of the members of both species did not take part in winter reproduction. In the beginning of June, the composition of the populations of siberian and collared lemmings was highly

uniform - all of them were adults, overwintered animals of very large size (see table). Furthermore, placental scars were absent from all females caught in June.

In the beginning of the first dekada of June, lemmings settled slightly dried up burrows of last year and began summer reproduction. The first siberian lemming female which had given birth was obtained on 17 June, collared on 29 June. Interruptions in reproduction were not observed. Immediately after the first appearance into the world of the first litter, females of both species which were pregnant for the second time began to be caught. Thus by 2 July two adult female siberian and collared lemmings were caught which had, besides palcental scars, embryos of a second litter. The average size of the first litter (according to the number of embryos and placental scars) of overwintered siberian lemming females (19 examined) obtained from 15 June to 15 July was 6.7 (range 6-8). The average size of the second litter in 14 siberian lemming females, caught from 2 to 15 July, was also 6.7 (range 5-9). In collared lemmings, obtained in the same periods, the first litter was, on the average, (based on 10 autopsied females) 5.3 (4-7); the second (based on 7 females) was 5.2 (4-6). The author did not have the opportunity to observedthe course of subsequent reproduction and the fate of the young of the first two litters. As was the statement in a number of investigations (Dunaeva and Kucheruk, 1941; Sutton and Hamilton, 1932; Krebs, 1964), winter breeding of lemmings usually precedes a "peak" or, at least, is indicative of the growth of numbers of the animals. The same picture, observed on the island in 1964, forces us to surmise the opposite occurrence - a slump in numbers. And, indeed, judged according to interrogatory information collected later,

It turned out that in the summer of 1965 the general number of both species of lemmings on Wrangel was considerably lower than that in 1964.

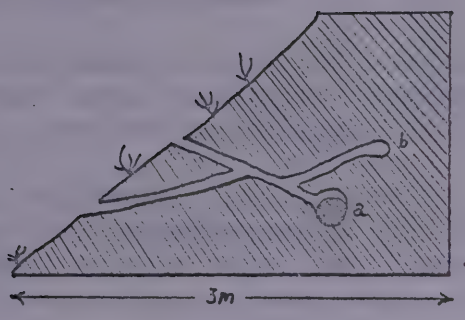

Diagram of the structure of collared lemming burrows
a - nesting chamber, b - lavatory

Weight and dimensions of adult lemmings from Wrangel, caught in June - July 1964

Indices	L. sibiricus (n=43)		D. Torquatus (n=22)	
	range	M±m	range	M±m
Weight, g.	63-119	94.1±2.38	71.0-132.2	93.9±6.28
body length, mm	118-145	134.9±1.13	124-138	132.4±1.75
foot length, mm	15.0-19.2	17.5±0.17	15.0-18.0	16.4±0.25
tail length, mm	14.5-19.0	15.9±0.18	15.0-21.0	17.1±0.51

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